CALIFORNIA ENERGY COMMISSION

Overview of Microgrid Assessment

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Joint Agency Workshop to Kick-Off the Development of a Roadmap to Commercialize Microgrids in California

California Energy Commission

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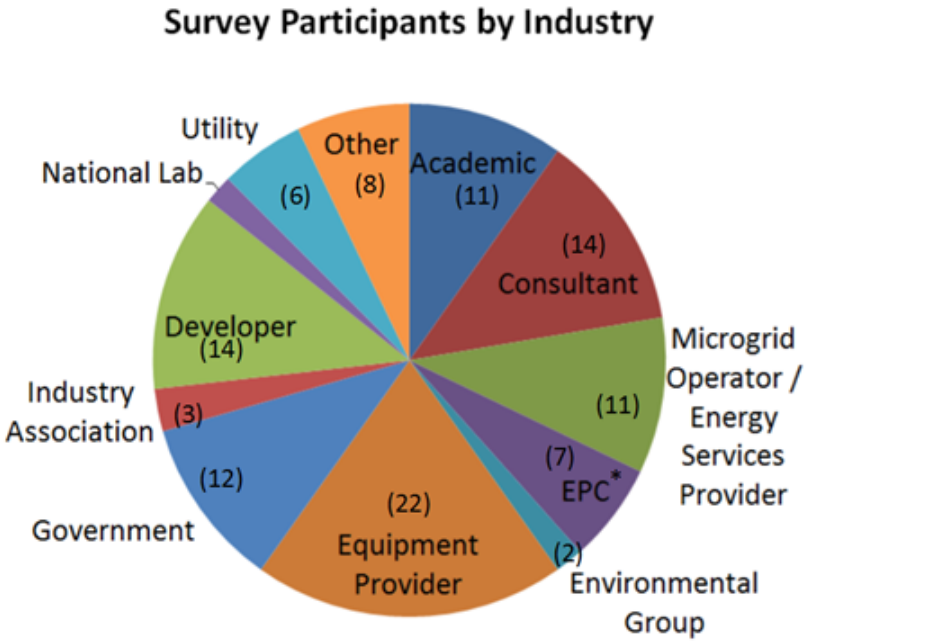
Microgrid Assessment

- Preliminary steps to assess issues and a basis for a more comprehensive roadmap
- Online public survey in January-March 2015
- Public workshop in March 2015

Survey Design and Participants

- 7 questions to capture background/experience
- 36 questions related to specific barriers
- 119 respondents- over half with experience outside of California



Survey Participant Background

Stated Experience in Microgrids	Number Of Participants	Percentage Of Participants
Participated in microgrid design, development, financing and/or operation	41	34%
Equipment supplier to presently operational microgrid or a microgrid under development	24	20%
Site host of an existing microgrid	6	5%
Theoretical understanding of microgrids, but not participated in a project	33	28%
Supplier interested in microgrids but not participated in a project	2	2%
Just beginning to understand microgrids	13	11%

Responses to Microgrid Functionality

Ranked Survey Responses for Functionality:

1. Increase reliability of local loads
2. Lower facility energy costs
3. Reduce GHG emissions

Note: Societal benefit noted by many respondents is the integration of renewables with improved local control and smoothing

Generation and Storage Technologies	Control and Integration Technologies
Integrated solar PV (88%)	Microgrid management system (83%)
Electric energy storage (81%)	Building energy management system (59%)
Fossil fuel turbine (57%)	Smart inverters for individual devices (57%)
Wind turbine (41%)	
Fuel cells (36%)	
Thermal energy storage (29%)	
Electric vehicles (26%)	

Survey Responses by Barrier Category

Participant Background	Barrier			
	Policy and Regulatory	Economic	Training and Standards	Technical
All participants (112)	**3.8**	**3.3**	**3.3**	**2.9**
Academic (11)	3.9	3.4	3.3	2.8
Consultant (14)	3.5	3.4	3.3	3.0
Microgrid Operator / Energy Service Provider (11)	3.9	3.1	2.9	2.70
Engineering / Procurement / Construction contractor (7)	4.2	3.9	3.9	2.8
Environmental (2)	5	N.A	N.A.	N.A.
Equipment Provider (22)	3.5	2.9	2.9	2.7
Government Agency (12)	3.7	3.7	3.5	3.5
Industry Association (3)	4.8	3.8	2.7	3.3
Developer (14)	3.9	3.2	3.3	2.8
National Lab (2)	4.0	3.4	2.7	4.3
Utility (6)	3.6	3.2	3.5	3.0
Other (8)	3.7	3.4	3.7	3.1

Top 10 Microgrid Barriers from Survey Responses

Barrier	Rank	Average score (5 highest, 1 lowest)
Lack of policies or regulations that enable microgrids	1	4.1
Interconnection rules impose limitations on microgrids	2	4.0
Utility franchise rights inhibit microgrid deployment	3	4.0
Existing retail tariffs do not allow all microgrid benefits to be monetized	4	3.9
High cost of meeting interconnection requirements	5	3.8
Lack of direct access to wholesale markets do not allow all microgrid benefits to be monetized	6	3.7
Lack of utility understanding of the impacts of end user microgrids to the utility	7	3.6
Adequacy of IEEE technical standards to address integration and operation of microgrids	8	3.5
Lack of clearly defined roles and responsibilities between utility and microgrids	9	3.5
Lack of standardized method to establish cost and value of microgrids to various stakeholders	10	3.5

Top 3 Barriers for Participant Groups

Participant Background (# of participants)	Barrier	Average score within industry group	Average score for all participants	Overall Rank by Importance
Academic (11)	Lack of policies or regulations that enable microgrids	4.3	4.1	1
	Lack of standardized contracts make financing projects difficult	4.3	3.2	20
	Existing retail tariffs do not allow all microgrid benefits to be monetized	4.2	3.9	4
Microgrid Operator / Energy Service Provider (11)	Interconnections rules impose limitations on microgrids	4.4	4.0	2
	High cost of meeting interconnection rules	4.3	3.8	5
	Lack of government assistance to reduce first mover risk for initial contract years	4.2	3.4	14
Equipment Provider (22)	Utility franchise rights inhibit microgrid deployment	3.9	4.0	3
	Existing retail tariffs do not allow all microgrid benefits to be monetized	3.9	3.9	4
	Interconnection rules impose limitations on microgrids	3.8	4.0	2

Top 3 Barriers for Participant Groups

Participant Background (# of participants)	Barrier	Average score within industry group	Average score for all participants	Overall Rank by Importance
Government Agency (12)	Lack of direct access to wholesale markets do not allow all microgrid benefits to be monetized	4.3	3.7	6
	Lack of experienced operators of microgrids	4.2	3.2	23
	Maturity and interoperability of microgrid system controls	4.0	3.3	19
Developer (14)	Lack of policies or regulations that enable microgrids	4.8	4.1	1
	Interconnection rules impose limitations on microgrids	4.4	4.0	2
	Utility franchise rights inhibit microgrid deployment	4.1	4.0	3
Utility (6)	Utility franchise rights inhibit microgrid deployment	4.7	4.0	3
	Cost of microgrid isolation and stability controls	4.2	3.3	17
	Lack of policies or regulations that enable microgrids	4.2	4.1	1

Initial Takeaways from Survey Responses

- Need for additional survey with broader participation and updated design
- Technical barriers related to interoperability of technologies and components from different vendors using varying control and communication protocols in new and legacy systems requires a high degree of customization.
- Interconnection is complex and expensive (time + cost).
- Financial models not proven to accurately capture operations.
- Early adopters appear to have demonstrated local reliability, though full range of grid services are still being verified.

Public Workshop in March 2015

- Purpose: An additional input into the assessment report
- Agenda included presentations on lessons learned from R&D projects
- Roundtable discussion to identify additional or complimentary barriers to the survey
- WebEx Workshop recording available:

http://www.energy.ca.gov/research/notices/index.html#03062015

Next Steps

-and-

Discussion